



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/790,212	03/02/2004	Junichi Tanaka	500.43597X00	1013
20457	7590	11/08/2006	EXAMINER	
ANTONELLI, TERRY, STOUT & KRAUS, LLP 1300 NORTH SEVENTEENTH STREET SUITE 1800 ARLINGTON, VA 22209-3873			KACKAR, RAM N	
			ART UNIT	PAPER NUMBER
			1763	

DATE MAILED: 11/08/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

C

Office Action Summary	Application No.	Applicant(s)	
	10/790,212	TANAKA ET AL.	
	Examiner	Art Unit	
	Ram N. Kackar	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 October 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) 7-9 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6 and 10-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-6 and 10-15 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The newly added limitation "edge roughness of mask sidewalls in a lateral direction of the mask" is not understood. It is not understood how and if it changes the scope of the claim. The specification does not appear to limit the orientation of roughness in a specific direction. At this point it is not clear if it is a new matter. For the purpose of this examination it is understood that the roughness is randomly distributed on the vertical mask sidewalls so that roughness projections are extending perpendicular to the wall. Applicant is requested to explain this with explanation and drawings if necessary.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Art Unit: 1763

3. Claims 1-6 and 10-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kagoshima et al (US Pub 2003/0003607) in view of an Article “ Modeling the impact of photoresist trim etch process on photoresist surface roughness” by Shahid Rauf et al.

Kagoshima et al disclose an etching apparatus for etching of mask features (Fig 1 and Abstract) with plasma and a plasma monitor (3) which could be an optical emission spectroscopy to monitor the species in the plasma. Kagoshima teaches optimum recipe calculation model which depends upon the monitored result from the plasma monitor (24) that the measurement of CD (22).

Kagoshima et al fail to disclose the roughness parameter of the resist and its impact on the recipe calculation model.

Shahid Rauf et al have extensively studied dependence of etch rate upon roughness when all other factors remain same. They teach that the etch rate is high at the beginning if the initial roughness is high, and reduces when the roughness is reduced. So that it is essential to know the initial roughness in order to estimate etch time needed to etch to target CD. Shahid Rauf et al teach that the roughness factor (RF) is measured as in Fig 1 by R profile of the roughness part and the spatial frequency computed using Fourier transform (Page 656 Col 2).

Therefore it would have been obvious for one of ordinary skill in the art at the time of invention to provide to the optimum recipe calculation model of Kagoshima et al, not only the monitored result of the plasma monitor and the measured CD, but the initial roughness (RF) of the mask in order to deal with the effect of roughness on recipe time.

Art Unit: 1763

Regarding the added limitation of “edge roughness of mask side walls in a lateral direction of the mask” the roughness dealt in the Article is three dimensional on the surface of the vertical sidewall (Page 656 – Col 2).

Regarding 11, this is an intended use claim.

Regarding claim 12 the articles measure of roughness as special frequency and amplitude is correlated to aspect ratio.

Response to Arguments

Applicant's arguments filed 10/12/2006 have been fully considered but they are not persuasive.

Regarding Applicant argument that according to the Article the two-dimensional model of this article will not apply to the type roughness characterized as vertical striations. However, neither vertical striations are claimed nor discussed in the specification. Therefore this point is not understood. The article is not limited to any particular orientation of roughness and clearly says that roughness of side walls is three-dimensional in nature (Page 656 Col 2 lines 4 and 5)

RF represents surface averaged roughness. Spatial frequency spectrum of PR surface roughness is also computed in the analysis tool using discrete Fourier transform.

Experiments have shown that roughness on PR sidewalls is three-dimensional in nature.^{7,10} This three-dimensional

Regarding applicant's second point Applicant argues that Rauf does not teach calculating arrangement for calculating trimming conditions for arriving at a target width.

Art Unit: 1763

The model for calculating thickness is disclosed by Kagoshima modified by the teaching of the Article to consider initial roughness also as a parameter.

Applicant's foreign representative's argument don't seem to be any different. The reference to Fig 1 as characterized by the Applicant's foreign representative is misplaced. The roughness as shown in the cross-section with the explanation discloses the nature of roughness clearly.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ram N. Kackar whose telephone number is 571 272 1436. The examiner can normally be reached on M-F 8:00 A.M to 5:P.M.

Art Unit: 1763

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571 272 1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Ram Kackar
Primary Examiner AU 1763